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(54) **ELECTRIC COUPLING ELEMENT**

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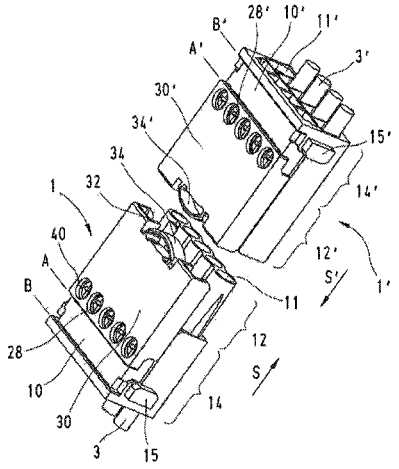
(57) **ABSTRACT**

The invention relates to an electric coupling element (**1**). Pin or socket contact elements (**20**), with which an electric means of a screwable connection means (**28**), are arranged in an electrically insulating main part (**10**). Openings (**18**) in the main part (**10**) are covered by means of a covering panel (**30**) I order to ensure the electric insulation of the individual contact elements (**20**). For assembly purposes, the covering panel (**30**) is movably attached to the main part (**10**) such that the covering panels (**30**, **30'**) of two coupling elements (**1**, **1'**) are mutually actuated when joined together.

**8 Claims, 4 Drawing Sheets**



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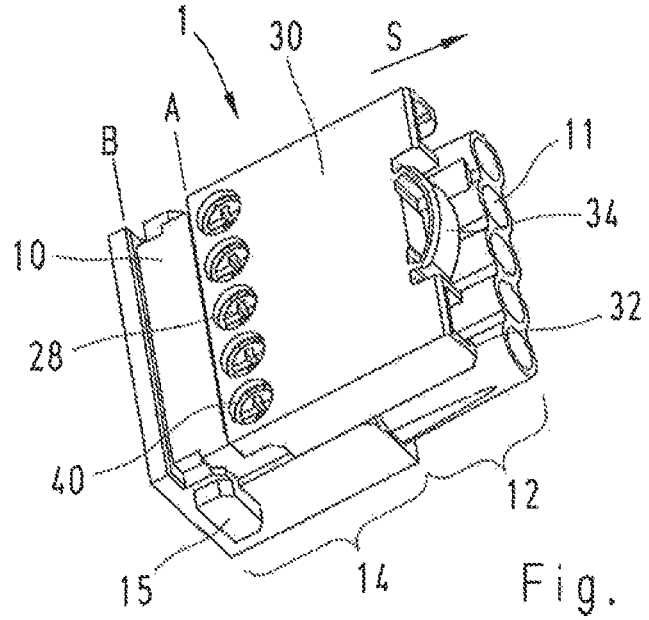


Fig. 1

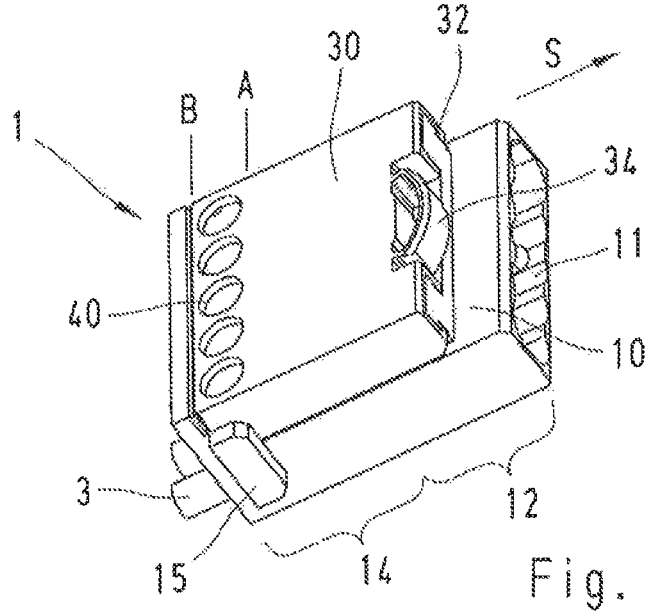


Fig. 2

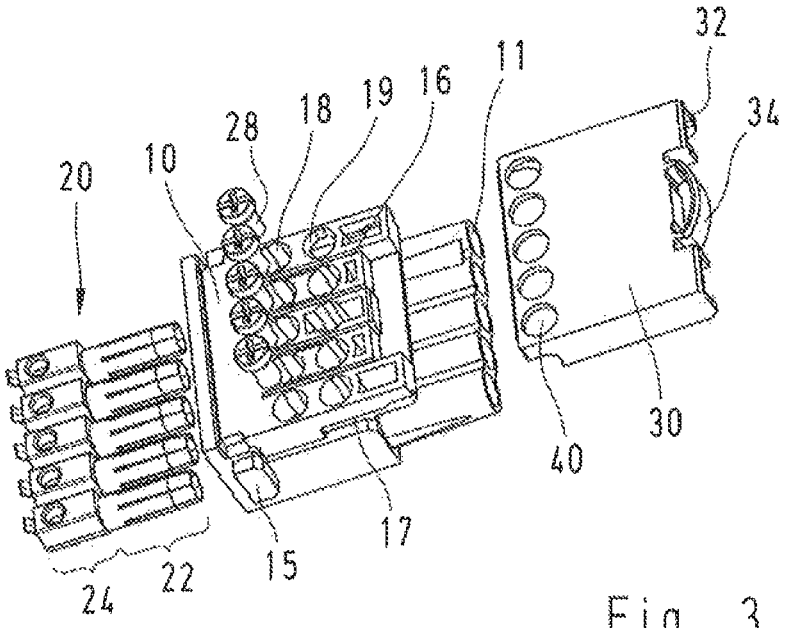


Fig. 3

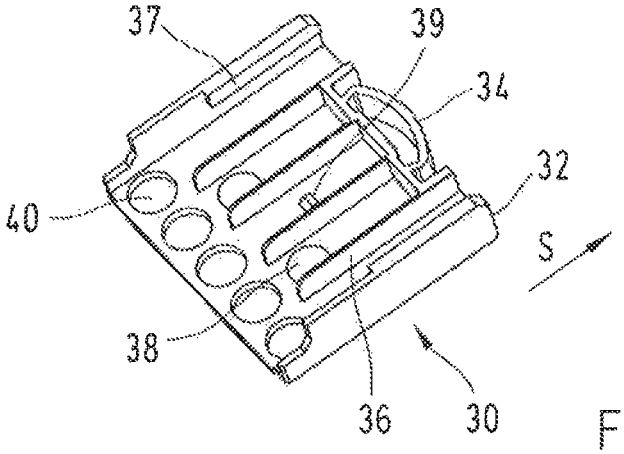


Fig. 4

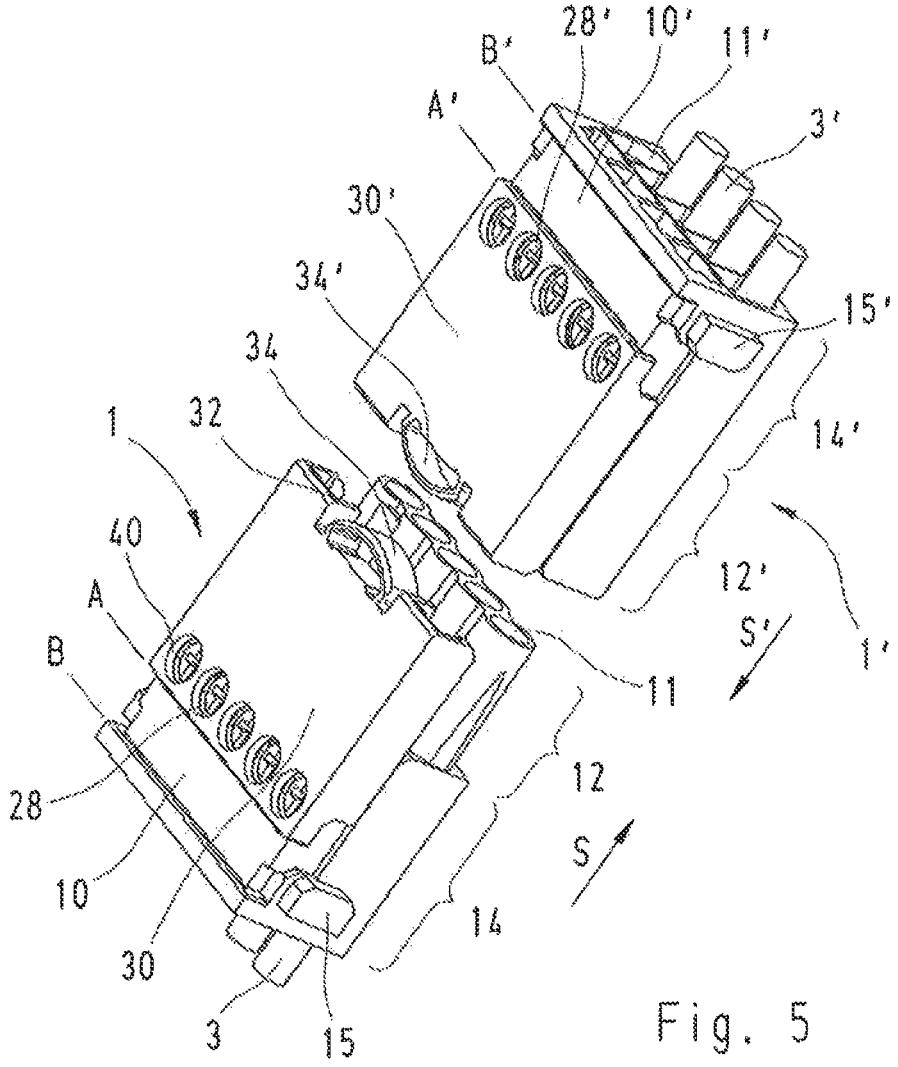


Fig. 5

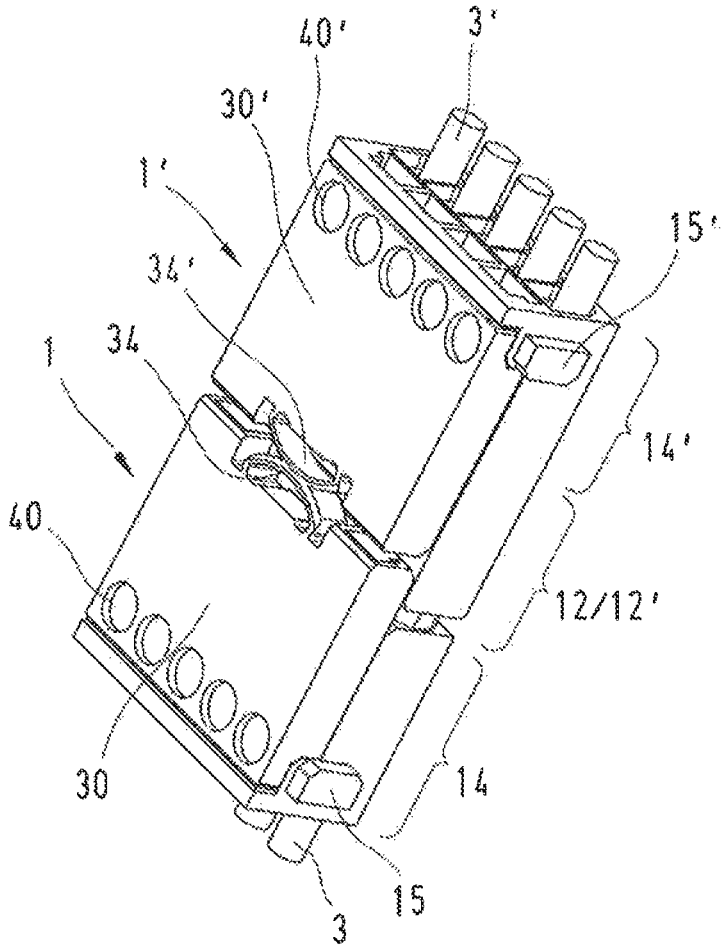


Fig. 6

# ELECTRIC COUPLING ELEMENT

The invention relates to an electric coupling element adapted to be disposed in a plug-in connector housing, preferably in a modular plug-in connector housing, consisting of an electrically insulating base body, wherein the base body includes contact cavities with electric contact elements provided therein, wherein the contact elements are preferably formed as socket or pin contacts, wherein the contact elements have a contact side that is at the front in the plug-in direction and a cable connection side that is at the rear in the plug-in direction, wherein the cable connection side is provided with connection means for fixing an electric conductor to the cable connection side of the contact element, and wherein the base body has openings that allow access to the connection means.

Such an electric coupling element is needed in order to reversibly connect electrically conductive braids, wires and cables to each other. An advantage of the mounting in a modular plug-in connector housing is that there is great flexibility in the compilation of the individual coupling elements of a plug-in connector. As a result, a plug-in connector can accommodate different conductor cross sections as well as different kinds of signal conductors. Thus, for example, electric conductors with optical conductors and pneumatic conductors can be combined as desired in a plug-in connector.

## PRIOR ART

Such plug-in connectors with a modular design are already known from many prior art documents. For example, DE 34 42 056 A1, DE 298 12 500 U1, DE 197 07 120 C1 and DE 43 11 781 C1 are known in this respect. All the plug-in connectors that are already known have a reception frame that is provided for receiving individual coupling elements, so-called modules, of different kinds.

The individual electric coupling elements are usually of a compact design and include a plurality of electric contacts, By providing the coupling elements with a compact and unitary size, they can be arranged in any desired order in a plug-in connector housing.

What is of disadvantage in all of the plug-in connectors known from the prior art is that due to the compact unitary size of the coupling elements, the types of electric contact elements that can be arranged therein is greatly limited.

Thus, most electric coupling elements have contact elements that are crimped onto the conductors to be connected. These are inserted into the coupling elements in the plug-in direction, where they are locked and can be removed only by means of a special tool. As an alternative, contact elements with so-called axial screw connections are known from the prior art.

The use of contact elements with a screw connection, for the assembly and disassembly of which merely a standard screwdriver instead of a special tool is necessary, is not possible. Since the contact elements are usually screwed in through openings on the side of the coupling elements, the clearances and creepage paths between the screw connection and the nearest coupling element or the receiving frame are too small as a result of the exposed screw connections and the compact design of the coupling elements.

Excessively small clearances and creepage paths can lead to a distortion of signals or even to short circuits between various contact elements or between contact elements and the receiving frame.

A further problem with exposed screw connections on coupling elements is contact safety, which is lacking. It is easily possible for a person handling plug-in coupling elements connected to a load to touch the exposed screw connections.



## OBJECT OF THE INVENTION

The invention is therefore based on the object of developing a coupling element in such a way that it can be used with screw contacts, without any other special tool being required for mounting, whilst at the same time the risk of short circuits is reduced.

This object is achieved by means of the fact that the electric element includes an electrically insulating cover plate, which cover plate is provided on the base body in front of the openings.

Advantageous embodiments of the invention are indicated in the dependent claims.

The invention relates to an electric coupling element provided for being disposed in a plug-in connector housing either alone or together with a plurality of other coupling elements. For the reception in the plug-in connector housing, a receiving frame is provided in the plug-in connector housing, which holds the coupling elements and by means of which the coupling elements can be fixed to the plug-in connector housing.

The rectangular base body of the coupling element is made from an electrically insulating material and has one or more reception cavities for electric contact elements, which continuously run along the plug-in direction. The contact elements formed as pin or socket contacts are provided in the coupling element in such a way that its contact side that is provided for electric contacting is located in the plug-in region of the coupling element that is at the front in the plug-in direction.

The coupling element has a connection region that faces away from the plug-in region and is at the rear in the plug-in direction. The connection region receives the rear part of the electric contact elements, the cable connection side. Any electric conductors to be connected are inserted into the coupling element in the connection region and are mechanically fixed in the cable connection side of the electric contact element.

The coupling element expediently includes latching means for fixing the coupling element in the mounting frame of the plug-in connector housing. The latching means are on the two narrow longitudinal sides of the rectangular coupling element. As a result, a plurality of coupling elements arranged end to end and disposed in the mounting frame lie next to each other with their wide longitudinal sides,

On one of the two wide longitudinal sides, the coupling element includes a number of openings that is identical with the number of reception cavities in the base body. The openings extend from the outside of the coupling element up into the respective reception cavity that is associated with the openings.

The openings are provided for receiving connection means, by means of which the electric conductors to be connected are fastened to the contact element. The connection means is preferably formed as a screw that is screwed into the cable connection side of the contact element and fixes in this way the electric conductor.

According to the invention, a cover plate is also provided on the wide longitudinal side, which also includes the openings for the connection means. The cover plate is an electrically non-conducting, planar element which partially covers one of the wider longitudinal sides of the coupling element.

It is expedient if the cover plate is attached to be movable so that it can carry out a linear movement in and opposite to the

plug-in direction. An end position of the cover plate, which is at the front in the plug-in direction, forms an open position, and an end position, which is at the rear in the plug-in direction, forms a closed position. The cover plate comprises a number of breakthroughs that is identical to the number of openings in the base body.

The diameter of the breakthroughs corresponds to that of the openings in the base body and their position, in the open position of the cover plate, coincides with that of the openings in the base body. If the cover plate is moved into the closed position, the cover plate covers the openings in the base body and it is not possible to access the connection means provided in the openings.

The cover plate is formed in the plug-in direction in such a way that in the fully plugged-in condition of the coupling element, it comes in frontal contact in the plug-in direction with the cover plate of a counter-coupling element. In this fully plugged-in condition, both cover plates, that of the coupling element and that of the counter-coupling element, are in a closed position, so that it is not possible to access the connection means.

The purpose of this dimensioning of the cover plates according to the invention is that the cover plates of two coupling elements to be mated will always push each other into the closed position, provided the cover plates are not in the closed position during the plugging together of the coupling elements.

In a preferred embodiment, the cover plate has one or more latching means on the side that faces the base body. These latching means engage in the openings of the base body in the closed position. In this way, any inadvertent displacement of the cover plate into the open position is avoided.

An advantageous embodiment of the coupling element provides for having further recesses in front of the openings in the plug-in direction for the connection means in the base body. The recesses are arranged in such a way that the latching means of the cover plate engage in the recesses in the open position and secure the cover plate in the open position against inadvertent closing.

In an expedient embodiment, the cover plate has ribs on the side that faces the base body, which ribs engage in grooves in the base body of the coupling element. These are used, in the closed position, for increasing the electric creepage paths between the individual contact elements of the coupling element.

## EMBODIMENT EXAMPLE

An embodiment example of the invention is shown in the drawing and will be explained in more detail below. In the drawings:

FIG. **1** shows a first embodiment of an electric coupling element with socket contact elements,

FIG. **2** shows a second embodiment of an electric coupling element with pin contact elements.

FIG. **3** shows an exploded view of a first embodiment of an electric coupling element,

FIG. **4** shows a cover plate,

FIG. **5** shows a first and second embodiment of two electric coupling elements in the non-plugged condition, and

FIG. **6** shows a first and second embodiment of two electric coupling elements in the plugged condition.

In FIG. **1**, a three-dimensional view of a first embodiment of an electric coupling element **1** is shown with socket contact elements. The electric coupling element **1** consists of a base body **10** that is made from an electrically non-conductive material. The base body **10** is formed from a plug-in region **12** that is at the front in the plug-in direction S and from a connection region **14** that is at the rear in the plug-in direction S.

In the plug-in direction **5**, a plurality—here five—of contact cavities **11** extends through the base body **10**, which contact cavities are used for receiving contact elements **20**. The plug-in region **12** is provided for coupling with a second coupling element **1**, whereas the contact region **14** is used for receiving electric conductors **3** to be connected.

Each of the narrow longitudinal sides of the base body **10** has one latching means **15** moulded thereto, which is used for receiving and latching the coupling element **1** in a plug-in connector housing. The shape and dimensions of the coupling elements **1** as well as the latching means **15** are standardised, so that is possible to combine and replace various coupling elements **1** in a plug-in connector.

On the top side of the coupling element **1** as shown in FIG. **1**, a cover plate **30** is shown. According to the invention, the cover plate **30** is provided for covering the connection means **28**. The connection means **28** are used for connecting the electric conductors **3** to the contact elements **20** which are received in the coupling element **1**. Preferably, the connection means **28** are formed as screws.

The cover plate **30** is here shown in a mounting position A which is at the front in the plug-in direction S. In this mounting position A, the connection means **28** can be accessed so as to operate the latter. Access to the connection means **28** is enabled by the breakthroughs **40** which are inserted into the cover plate **30** and which in the mounting position A are located above the connection means **28**.

A second embodiment with in contact elements is also shown in a three-dimensional view in FIG. **2**. This embodiment differs from the embodiment of FIG. **1** by an adapted plug-in region **12**, in order to correspondingly receive contact elements **20** which are formed as pin contact elements.

In FIG. **2**, the cover plate **30** is shown in a working position B which is at the rear in the plug-in direction S. In this position, which is linearly displaced opposite to the plug-in direction S, it is not possible to access the connection means **28**. The cover plate **30**, which is also made from an electrically non-conductive material, covers the connection means **28**, so that neither a mechanical nor an electrical access thereto is possible.

A first embodiment of a coupling element **1** is shown in FIG. **3** in a three-dimensional exploded view. In the left-hand region, the five contact elements **20** are shown, which are here formed as socket contact elements. The contact elements **20** have a cable connection side **24** which is at the rear in the plug-in direction S, which is designed for receiving an electric conductor **3** and which both mechanically and electrically contacts said electrical conductor **3**. For a mechanical contacting of the conductor **3**, the connection means **28**—here screw—are screwed into the cable connection side **24** and clamp the inserted conductor **3**.

The region of the contact elements **20** which is at the front in the plug-in direction S is formed by the contact side. These contact elements **20**, which are here formed as socket contacts, are used for contacting the contact elements **20'** of a counter-coupling element **1'**.

In the central part of FIG. **3**, the base body **10** of the coupling element **1** is shown. The plug-in region **12** of the coupling element **1** is provided for receiving the contact side **22** of the contact elements **20**, and the connection region **14** is provided for receiving the cable connection side **24** of the contact elements **20**.

On the upper, wide longitudinal side of the base body **10**, openings **18**—here five—are provided in a corresponding

number of contact elements **20**. The openings **18** reach from the top face of the base body **10** into the contact cavities **11**, in which the contact elements **20** are provided.

The openings **18** are provided for receiving the connection means **28** and to allow access thereto. The connection means **28** are screwed in through the openings **18** in the cable connection sides **24** of the contact elements **20**.

On its narrow longitudinal sides, the base body **10** preferably includes guiding grooves **17** which are used for guiding and anchoring the cover plate **30**. The cover plate **30** is guided by means of guiding strips **37** into the guiding grooves **17** and can in this way carry out a linear movement in the plug-in direction S between the mounting position A and the working position B.

In the plug-in direction S next to the openings **18**, additional recesses **19** are provided, which are used for latching the cover plate **30** in the mounting position A. To this end latching means **38**, which are located on the side of the cover plate **30** that faces the base body **10**, latch into the recesses **19**. The shape of the recesses **19** corresponds to that of the openings **18**, as a result of which in the working position B, the cover plate **30** can latch in the openings **18** with the latching means **39**.

The latching means **38** are formed as flat elevations on the cover plate **30**. These fit, in terms of their shape and size, exactly into the openings **18** and the recesses **19** and retain in this way the cover plate **30** in the mounting position A or in the working position B.

In the right-hand region of FIG. **3**, a cover plate **30** according to the invention is shown which is also shown in FIG. **4** from the side facing the base body **10**. The cover plate **30** is generally U-shaped and is made from an electrically non-conductive material. The U-shape is intended to ensure that the cover plate **30** at least partially encompasses the base body **10**. The guiding strips **37**, which are moulded onto the inside of the cover plate **30**, engage in the guiding grooves **17** on the base body **10** and retain in this way the cover plate **30** on the base body **10**. The guiding grooves **17** allow a linear movement of the cover plate **30** directed in the plug-in direction S from the mounting position A to the working position B.

In the embodiment shown, the cover plate **30** has a spring element **34** that is attached to the cover plate **30** in the region **32** that is at the front in the plug-in direction S. The spring element **34** exerts a force on the cover plate **30**, when the coupling element **1** is contacted by a second coupling element **1**, and forces the cover plate **30** into the working position B.

According to the invention, ribs **36** are moulded to the side of the cover plate **30** that faces the base body **10**. The ribs **36** are plunged into grooves **16** on the base body **10**. As a result of the ribs **36** being plunged into the grooves **16**, the electric creepage paths between the individual contact elements **20** in the base body **10** are enlarged.

In the embodiment shown, the cover plate **30** has an additional stop **39** that is supposed to prevent, during the displacement of the cover plate **30** into the mounting position A, an inadvertent removal of the cover plate **30** from the base body **10**.

FIG. **5** and FIG. **6** each show a pair of coupling elements **1**, **1'** in a non-plugged condition and in a plugged condition, respectively. What can be seen are the oppositely shown coupling elements **1**, **1'**, wherein the coupling element **1** is provided with socket contacts and the coupling element **1'** is provided with pin contacts. In the connection regions **14**, **14'** of the base bodies **10**, **10'**, which are each at the rear in the plug-in directions S, S', electric conductors **3**, **3'** are shown which are electrically connected in the coupling elements **1**, **1'** with the contact elements **20**, **20'** which cannot be seen here. In FIG. **6**, the plug-in regions **12**, **12'** are mated together in the plugged-in condition.

According to the invention, FIG. **5** shows the cover plates **30**, **30'** in the mounted position A. In this position, they allow access to the connection means **28**, **28'**, by means of which the electric conductors **3**, **3'** are mechanically and electrically fixed in the contact elements **20**, **20'**.

In the plugged-in condition, as shown in FIG. **6**, the cover plates **30**, **30** are in the working position B and cover in this way the access to the connection means **28**, **28'**. As a result of the plugging in of the coupling elements **1**, **1'**, the cover plates **30**, **30'** have displaced each other into the working position B. The spring elements **34**, **34'** push against each other and exert in this way a force onto the cover plates **30**, **30'**, which retain the covers **30**, **30'** in the working position B.

Electric Coupling Element

List of Reference Numerals

**1** Coupling element
**3** Electric conductor
**10** Base body
**11** Contact cavity
**12** Plug-in region
**14** Connection region
**15** Latching means
**16** Groove
**17** Guiding groove
**18** Opening
**19** Recess
**20** Contact element
**22** Contact side
**24** Cable connection side
**28** Connection means
**30** Cover plate
**32** Front region
**34** Spring element
**36** Rib
**37** Guiding strip
**38** Latching means
**39** Stop
**40** Breakthrough
A Mounting position
B Working position
S Plug-in direction

The invention claimed is:

**1**. An electric coupling element (**1**) adapted to be disposed in a plug-in connector housing, preferably in a modular plug-in connector housing, comprising,

an electrically insulating base body (**10**),

wherein the base body (**10**) includes contact cavities (**11**) with electric contact elements (**20**) provided therein,

wherein said contact elements (**20**) are preferably formed as socket or pin contacts,

wherein said contact elements (**20**) have a contact side (**22**) that is at the front in the plug-in direction (S) and a cable connection side (**24**) that is at the rear in the plug-in direction (S),

wherein the cable connection side (**24**) has a connector screw (**28**) for fastening an electric conductor (**3**) to the cable connection side (**24**) of the contact element (**20**), and

wherein said base body (**10**) has openings (**18**) which allow access to the connector screw (**28**),

wherein said electric coupling element (**1**) further comprises an electrically insulating cover plate (**30**),

said cover plate (**30**) provided on the base body (**10**) to overlie the openings (**18**) and connector screw (**28**), characterised in that

said cover plate (**30**) is arranged on said base body so as to be linearly displaceable in and opposite to the plug-in direction (S) to open and close the openings (**18**) without contact with the electric conductor (**3**), the contact element (**20**), or the connector screw (**28**).

**2**. The electric coupling element (**1**) as claimed in claim **1**, characterised in that the cover plate (**30**) allows access to the openings (**18**) in a first open position (A), which is at the front in the plug-in direction (S), and covers the openings (**18**) in a second closed position (B), which is at the rear in the plug-in direction (S).

**3**. An electric coupling element (**1**) adapted to be disposed in a plug-in connector housing, preferably in a modular plug-in connector housing, comprising,

an electrically insulating base body (**10**),

wherein the base body (**10**) includes contact cavities (**11**) with electric contact elements (**20**) provided therein,

wherein said contact elements (**20**) are preferably formed as socket or pin contacts,

wherein said contact elements (**20**) have a contact side (**22**) that is at the front in the plug-in direction (S) and a cable connection side (**24**) that is at the rear in the plug-in direction (S),

wherein the cable connection side (**24**) has a connector (**28**) for fastening an electric conductor (**3**) to the cable connection side (**24**) of the contact element (**20**), and

wherein said base body (**10**) has openings (**18**) which allow access to the connector (**28**),

wherein said electric coupling element (**1**) further comprises an electrically insulating cover plate (**30**),

and said cover plate (**30**) is provided on the base body (**10**) in front of the openings (**18**),

said cover plate (**30**) is arranged on said base body so as to be linearly displaceable in and opposite to the plug-in direction (S) to allow access to the openings (**18**) in a first open position (A), which is at the front in the plug-in direction (S), and covers the openings (**18**) in a second closed position (B), which is at the rear in the plug-in direction (S), wherein said electric coupling element is matable with another electric coupling element by contact between the fronts of each electric coupling element in the plug-in direction with the cover plates (**30**, **30'**) of the two completely mated coupling elements (**1**) each located in their rear, closed position (B, B').

**4**. The electric coupling element (**1**) as claimed in claim **3**, characterised in that a spring element (**34**) is provided in a region (**32**) of the cover plate (**30**) that is at the front in the plug-in direction (S), which spring element, in the fully mated condition of the electric coupling element (**1**), generates a force with said mated electric coupling element (**1'**), which forces the cover plates (**30**, **30'**) each into the rear closed position (B, B').

**5**. The electric coupling element (**1**) as claimed in claim **3**, characterised in that the cover plate (**30**) has one or more ribs (**36**) on the side that faces the base body (**10**), which ribs engage, in the rear, closed position (B), in grooves (**16**) in the base body (**10**), and

wherein the grooves (**16**) extend along the plug-in direction (S) between the openings (**18**).

**6**. The electric coupling element (**1**) as claimed in claim **3**, characterised in that the cover plate (**30**) has at least one latch (**38**) on the side facing the base body (**10**),

wherein the latch (**38**) engages in one of the openings (**18**) in the rear, closed position (B).

**7**. The electric coupling element (**1**) as claimed in claim **3**, characterised in that said connector (**28**) is a screw.

**8**. An electric coupling element (**1**) adapted to be disposed in a plug-in connector housing, preferably in a modular plug-in connector housing, comprising,

an electrically insulating base body (**10**),

wherein the base body (**10**) includes contact cavities (**11**) with electric contact elements (**20**) provided therein,

wherein said contact elements (**20**) are preferably formed as socket or pin contacts,

wherein said contact elements (**20**) have a contact side (**22**) that is at the front in the plug-in direction (S) and a cable connection side (**24**) that is at the rear in the plug-in direction (S),

wherein the cable connection side (**24**) has a connector (**28**) for fastening an electric conductor (**3**) to the cable connection side (**24**) of the contact element (**20**), and

wherein said base body (**10**) has openings (**18**) which allow access to the connector (**28**),

wherein said electric coupling element (**1**) further comprises an electrically insulating cover plate (**30**),

and said cover plate (**30**) is provided on the base body (**10**) in front of the openings (**18**),

said cover plate (**30**) is arranged on said base body so as to be linearly displaceable in and opposite to the plug-in direction (S) to open and close the openings (**18**) without contact with the electric conductor (**3**), the contact element (**20**), or the connector (**28**), and to allow access to the openings (**18**) in a first open position (A), which is at the front in the plug-in direction (S), and to cover the openings (**18**) in a second closed position (B), which is at the rear in the plug-in direction (S),

wherein said cover plate (**30**) has a stop (**39**) on the side facing the base body (**10**),

wherein the stop (**39**) hooks into the base body (**10**) in the open position (A) and avoids a complete removal of the cover plate (**30**) from the base body (**10**).

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